1. Scope

1.1 This specification covers hot-finished or cold-finished precipitation hardening iron base superalloy bars, forgings, and forging stock for high-temperature service. The mechanical properties of these alloys are developed by suitable solution treating and precipitation hardening treatments.

1.2 Two grades of iron base alloy are covered. Selection will depend upon design, service conditions, mechanical properties, and elevated temperature characteristics.

1.3 The values stated in either inch-pound units or SI (metric) units are to be regarded separately as standards; within the text and tables, the SI units are shown in [brackets]. The values stated in each system are not exact equivalents; therefore, each system must be used independent of the other. Combining values from the two systems may result in nonconformance with the specification.

1.4 Unless the order specifies an “M” designation, the material shall be furnished to inch-pound units.

2. Referenced Documents

2.1 ASTM Standards:

A484/A484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

3. Ordering Information

3.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements may include, but are not limited to, the following:

3.1.1 Quantity (weight or number of pieces),
3.1.2 Name of material (precipitation hardening iron base superalloy),
3.1.3 Form (bars, forgings, and forging stock),
3.1.4 Dimensions (in the case of rough or finished forgings the order shall be accompanied by a print or drawing or otherwise adequately described as to the shape and dimension),
3.1.5 Grade designation (Table 1),
3.1.6 Condition (Section 5),
3.1.7 Finish (Section 3),
3.1.8 Mechanical requirements (Section 8),
3.1.9 ASTM designation, and
3.1.10 Special requirements.

4. General Requirements

4.1 In addition to the requirements of this specification, all requirements of the current edition of Specification A484/A484M shall apply. Failure to comply with the general requirements of Specification A484/A484M constitutes nonconformance with this specification.

5. Condition

5.1 The product forms covered in this specification may be furnished in one of the following conditions:

5.1.1 Hot-finished,
5.1.2 Solution treated (Grade 660 only—Type 1 or Type 2 solution treatment as specified),
5.1.3 Solution and precipitation treated (Grade 660 only—Type 1 or Type 2 solution treatment as specified), or
5.1.4 Other as specified.

6. Heat Treatment

6.1 Samples cut from bars, forgings, or a sample forged from the forging stock shall conform to the mechanical properties of Table 1 and Table 2 when heat treated as prescribed in Table 3.
6.2 When a sample cut from the forging stock and heat treated as prescribed in Table 2 conforms to the properties in Tables 3 and 4, it shall be accepted as equivalent to a forged coupon.

7. Chemical Composition

7.1 The steel shall conform to the requirements for chemical composition specified in Table 4.

7.2 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A751, except that for remelt material, product analysis tolerances may be used to determine conformance to this specification.

7.3 For referee purposes, Test Methods E30 shall be used.
7.4 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Definitions A751, except that for remelt material, product analysis tolerances may be used to determine conformance to this specification.

8. Mechanical Properties

8.1 The material shall conform to the mechanical property requirements specified in Table 1 after heat treatment as described in Table 3.

8.2 The material shall meet the requirements as to stress-rupture properties specified in Table 2 at the test temperature indicated after heat treatment as described in Table 3.

8.3 When specified in the ordering information (3.1.8), material may be ordered without stress-rupture testing. Material not stress-rupture tested shall be permanently stamped NR (See Section 10).

9. Metallurgical Properties

9.1 When specified, the grain size shall be 1 or finer.

10. Product Marking

10.1 Unless otherwise specified on the purchase order, each bundle shall be properly tagged with metal tags showing the purchase order number, heat number, name of alloy (or grade), “NR” when material has not been stress-rupture tested, specification number, and size.

10.1.1 Bars 1 in. [25 mm] and over in diameter, or 1 in. [25 mm] and over in thickness between parallel sides, shall be stamped with the heat number, and if not stress-rupture tested, with the letters “NR” within approximately 2 in. [50 mm] of one end. Smaller sizes shall be boxed or bundled and identified with metal tags as described in 10.1.

10.1.2 Forgings shall be identified as agreed upon between the seller and the purchaser.

11. Keywords

11.1 precipitation hardening superalloy steel; superalloy steel bars; superalloy steel billets; superalloy steel forgings; temperature service applications—high

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A638/A638M – 00 (2004)) that may impact the use of this standard. (Approved April 1, 2010.)

(1) Revised column heading in Table 2.